

BioInspired Design Decal Syllabus



Class Number: #24217

Course Credit: 2 units, Pass/No Pass

Location: Jacobs Hall Room 10C

Time: Mondays 6:30-8 PM

<http://biodesign.berkeley.edu/>

Facilitator(s): Tatum Dwyer, tdwyer@berkeley.edu

Faculty Advisor: Professor Robert Full, rjfull@berkeley.edu

Course Description:

Bioinspired design views the process of how we learn from Nature as an innovation strategy translating principles of function, performance and aesthetics from biology to human technology. The creative design process is driven by interdisciplinary exchange between engineering, biology, medicine, art, architecture and business. In this course, we will learn about the biomimicry design process, ranging from original scientific breakthroughs to entrepreneurial start-ups using case studies that include gecko-inspired adhesives, robots that run, fly and swim, artificial muscles, computer animation, medical devices and prosthetics while highlighting health, the environment, and safety. All majors are welcomed.

Course Learning Objectives:

- Outline the process, practice, and applications of bioinspired design.
- Facilitate further interest in innovation.
- Understand how to analyze academic literature and apply concepts learned.
- Foster teamwork between students of different disciplines and backgrounds.

Course Structure:

Section will include a half-an-hour of lecture, while the rest of the time will be spent focusing on collaborative activities, demos, discussions, and brainstorming workshops.

Textbooks and Required Materials

- Jacobs Hall Maker Pass (\$100). Fee waivers are available for students with financial need. This will allow you to create prototypes and models of your designs, as well as give you access to use 3D printers, laser cutters, etc.
- Sketchbook/Idea Notebook
- No prerequisites or textbooks are required for this course.

Grading Policy:

This course is graded on a P/NP basis. Regular attendance, participation and completion of assignments is required for a Pass grade. A minimum grade of 70% is required to pass.

Late Grading Policy: For earlier assignments, such as completing the teaming survey and discovery decomposition assignment, half points will be awarded if these are completed a week after they are due, and no points will be awarded for completing the assignments two weeks after it is due. For later assignments, the policy for late grades will be determined on a case-by-case basis.

Grade Breakdown:

- 25% - Final Project Presentation
- 30% - Team Article Review
- 45% - Attendance & Participation

Attendance:

You must attend all of the weekly sections. You are allowed one excused absence as defined by the university (e.g., documented illness, family emergency, etc.) and one unexcused absence (with exceptions for special circumstances, e.g. midterms or athletic events). An excused absence won't excuse you from completing the readings.

Final Project:

Students will be assigned teams and work on a bioinspired project of their choice during the last 6 weeks of the course. Each student team will make a five minute presentation for their project. More details will be provided near the end of the semester.

Team Article Review:

You will be required to submit a review of a primary literature article related to biodesign with your assigned team, which will serve as the basis for your final design project.

Please try to provide interesting articles that you would want to read, as your submitted articles and comments may be used as material in next semester's reader.

This assignment consists of the following items:

- A printed or original copy of an article from a reputable source. Articles CANNOT be from non-peer-reviewed sources, and the article must have an author and date of when it was published.
- Bibliographical Information (source, date, author, volume, etc.) APA formatted.
- A one-page description of the article.
- One page describing the bioinspired product you would make from applying your scientific publication. This one page should be double-spaced, Times New Roman with one-inch margins, and size 12 font.
- A list of all the products you can make by applying the findings in your chosen bioinspired research article.

Guest Speakers and Workshops (subject to change):

We will have three guest speakers throughout the duration of the course. Guest speakers will include: Professor Robert Full, Mo. Na. Gems Creators Mecca McDonald and Mia Dunn, and more. Workshops will include a laser cutting workshop, Adobe Photoshop and Illustrator workshop, and hand prosthetic lab.

Readings:

Each week there will be readings assigned. There will be no quiz to test your understanding, but as lecture will center around your understanding of the material, you must be familiar with the readings before class.

Accommodations:

Students who need academic accommodations should request them from the Disabled Students' Program, <https://dsp.berkeley.edu>. DSP is the campus office responsible for verifying disability-related needs for academic accommodations, assessing that need, and for planning accommodations in cooperation with students and instructors as needed and consistent with course requirements. If you are having trouble or if there is a delay in gaining your DSP letter, then feel free to contact the course facilitator to determine the level of accommodation you need.

Course Schedule

Week	Course Content Lecture	Activity (*subject to change)
Week 1. Sept. 13	Course Introduction:	

	What is Bioinspired Design?	
Week 2. Sept. 20	(Continued) What is Bioinspired Design?	Guest Speaker Professor Robert Full
Week 3. Sept. 27	BioDesign - How do I design from Nature?	"How to Read A Biology Paper" Workshop
Week 4. Oct. 4	BioSelection - How do I select the best inspiration?	Team Name + Logo Assignment
Week 5. Oct. 11	BioConstraints - How are Nature's designs compromised?	TBA
Week 6. Oct. 18	BioScaling - How do I consider size?	Gecko-inspired Adhesive Demo
Week 7. Oct. 25	BioProsthetics Introduce Final Project	3D printing + Fusion360 Workshop
Week 8. Nov. 1	BioMaterials	Guest Speakers Mecca McDonald and Mia Dunn
Week 9. Nov. 8	BioComplexity - How to Simplify and Extract Principles?	Design Workshop - Toy Design (inspired by Kamigami Robots and Prof. Cas Holman)
Week 10. Nov. 15	BioAnimation	TBA
Week 11. Nov. 22	Final Presentation and Deliverable Due	TBA
Week 12. Nov. 29	Final Presentations	End of Semester Celebration Potluck

Reading List:

Readings and Link (*subject to change)	Due Before:
<p>“How Animals Color Themselves With Nanoscale Structures”</p> <p>https://www.quantamagazine.org/how-blue-animals-color-themselves-with-nanostructures-20210616/</p>	Class 1
<p>“Cats use hollow papillae to wick saliva into fur”</p> <p>https://www.pnas.org/content/115/49/12377</p> <p>“How cat tongues work– and can inspire human tech”</p> <p>https://www.nationalgeographic.com/animals/article/understanding-cat-tongues-papillae</p>	Class 2
<p>“Marine Terpenoids from Polar Latitudes and Their Potential Applications in Biotechnology”</p> <p>https://www.mdpi.com/1660-3397/18/8/401/htm</p>	Class 3
<p>Gecko-inspired adhesives help soft robotic fingers get a better grip</p> <p>https://www.sciencedaily.com/releases/2018/04/180410110903.htm</p> <p>A Golden Age of Design</p> <p>https://www.nytimes.com/2014/09/22/t-magazine/design-golden-age.html</p>	Class 4
<p>New camera inspired by butterfly eyes improves image-guided cancer surgery</p> <p>https://www.sciencedaily.com/releases/2018/04/180405101727.htm</p>	Class 5

Scientists mimic a worm's lethal jaw to design and form resilient materials https://phys.org/news/2018-04-scientists-mimic-worm-lethal-jaw.html	
Team's Bioinspired Slick Method Improves Water Harvesting https://www.utdallas.edu/news/2018/4/2-32909_Teams-Bioinspired-Slick-Method-Improve-s-Water-Harv_story-wide.html?WT.mc_id=NewsHomePage	Class 6
How Insects Have Impacted Sensor Design https://www.azosensors.com/article.aspx?ArticleID=1085	Class 7
Camera Inspired By Mantis Shrimp May Help With Underwater Navigation http://www.techtimes.com/articles/224451/20180405/camera-inspired-by-mantis-shrimp-may-help-with-underwater-navigation.htm	
The Rise of Biotechnology in Fashion and Design https://luxiders.com/biotechnology-in-fashion-and-design/	Class 8
Eggshells' Remarkable Design – A Tribute to Mindless Evolution? https://evolutionnews.org/2018/04/eggshells-remarkable-design-a-tribute-to-mindless-evolution/	Class 9

<p>After an explosion, send in a spider-bot https://www.c4isrnet.com/industry/2018/04/05/after-an-explosion-send-in-a-spider-bot/ https://www.pddnet.com/news/2018/04/mars-bee-swarm-flapping-wing-flyers-enhanced-mars-exploration</p>	Class 10
<p>Wing origami https://www.nature.com/articles/d41586-018-03775-4</p>	Class 11
<p>Meet the UD researcher working on 'technology that would eliminate doors' https://technical.ly/delaware/2018/04/09/no-doors-gary-chang-hypercell-ud-ixd/</p>	Class 12